

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
20 January 2005 (20.01.2005)

PCT

(10) International Publication Number
WO 2005/006065 A3

(51) International Patent Classification⁷: **G02F 1/1334**

(21) International Application Number:
PCT/IB2004/051174

(22) International Filing Date: 8 July 2004 (08.07.2004)

(25) Filing Language: Italian

(26) Publication Language: English

(30) Priority Data:
TO2003A000530 9 July 2003 (09.07.2003) IT

(71) Applicant (for all designated States except US): INFM IS-
TITUTO NAZIONALE PER LA FISICA DELLA MA-
TERIA [IT/IT]; Corso F. Perrone 24, I-16152 GENOVA
(IT).

(72) Inventors; and

(75) Inventors/Applicants (for US only): CAPUTO, Roberto
[IT/IT]; Via Parigi 21, I-87036 RENDE (Cosenza) (IT).
UMETON, Cesare [IT/IT]; Via Tevere 68, I-87036
RENDE (Cosenza) (IT). VELTRI, Alessandro [IT/IT];
Via P. Borsellino - Fabbriato S.E.M., s.n., I-87100
COSENZA (IT). SUKHOV, Andrey [RU/RU]; pr.
Karamzina 9 - Apt. 60, MOSCOW, 117463 (RU).
TABIRYAN, Nelson [AM/US]; 809 South Orlando Av-
enue - Suite I, WINTER PARK, Florida 32789 (US).

(74) Agent: RAMBELLI, Paolo; Corso Regio Parco 27,
I-10152 TORINO (IT).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
MG, MK, MN, MW, MX, MY, NA, NI, NO, NZ, OM, PG,
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
ZW.

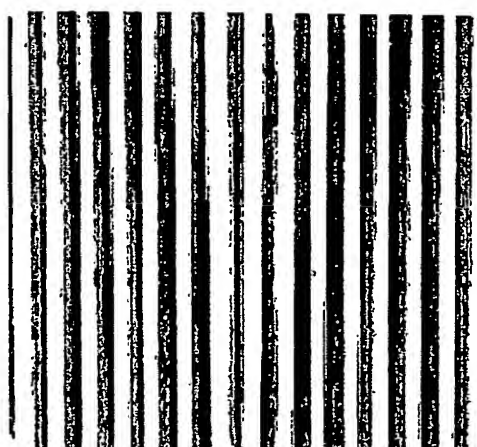
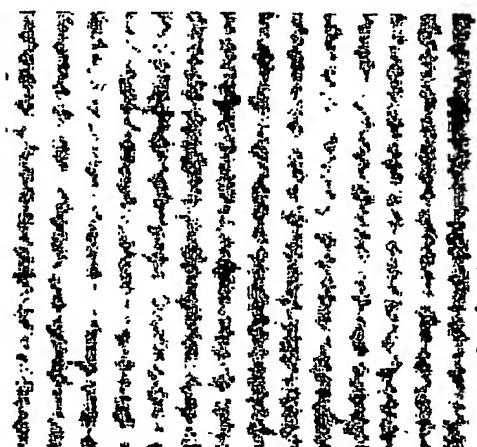
(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI,
SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted
a patent (Rule 4.17(ii)) for the following designations AE,
AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ,

[Continued on next page]

(54) Title: HOLOGRAPHIC DIFFRACTION GRATING, PROCESS FOR ITS PREPARATION AND ELECTRO-OPTICAL DE-
VICES INCLUDING THE SAME



(57) Abstract: Composite polymer/liquid crystal material having a holographic grating structure formed by an alternating ordered succession of crystal layers. The nematic liquid crystal monophase region which is substantially free from furthermore, the holo-
graphic grating structure is comprises the steps of: -heating a mixture of a photoinitiator, a monomer Composite polymer/liquid
crystal material having a holographic grating structure of polymer layers and nematic liquid layers comprise an ordered nematic liq-
uid crystal droplets. obtained by a process which above the nematic/isotropic phase phase separation -illumination of -tion; -slow
cooling of transition and a nematic liquid crystal and the temperature, in order to prevent isotropic/nematic phase transition of the
liquid crystal; mixture at a rate lower than 0,3°C/mixture, to achieve a mixture with an interference pattern to induce polymerise the
complete orientation of the liquid crystal director, and below the isotropic/nematic transition temperature.



CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

— of inventorship (Rule 4.17(iv)) for US only

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:

17 February 2005

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

CORRECTED VERSION

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
20 January 2005 (20.01.2005)

PCT

(10) International Publication Number
WO 2005/006065 A3

(51) International Patent Classification⁷: **G02F 1/1334**

(21) International Application Number:
PCT/IB2004/051174

(22) International Filing Date: 8 July 2004 (08.07.2004)

(25) Filing Language: Italian

(26) Publication Language: English

(30) Priority Data:
TO2003A000530 9 July 2003 (09.07.2003) IT

(71) Applicant (for all designated States except US): **INFM ISTITUTO NAZIONALE PER LA FISICA DELLA MATERIA** [IT/IT]; Corso F. Perrone 24, I-16152 GENOVA (IT).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **CAPUTO, Roberto** [IT/IT]; Via Parigi 21, I-87036 RENDE (Cosenza) (IT). **UMETON, Cesare** [IT/IT]; Via Tevere 68, I-87036 RENDE (Cosenza) (IT). **VELTRI, Alessandro** [IT/IT]; Via P. Borsellino - Fabbicato S.E.M., s.n., I-87100 COSENZA (IT). **SUKHOV, Andrey** [RU/RU]; pr.

Karamzina 9 - Apt. 60, MOSCOW, 117463 (RU). **TABIRYAN, Nelson** [AM/US]; 809 South Orlando Avenue - Suite I, WINTER PARK, Florida 32789 (US).

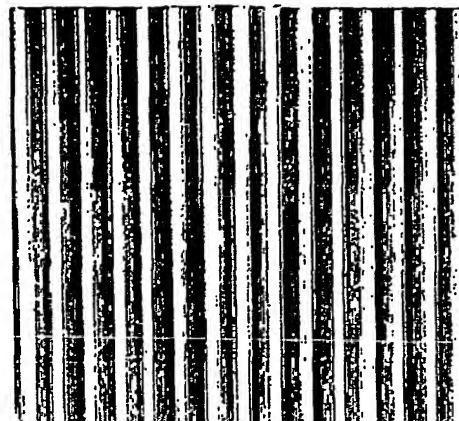
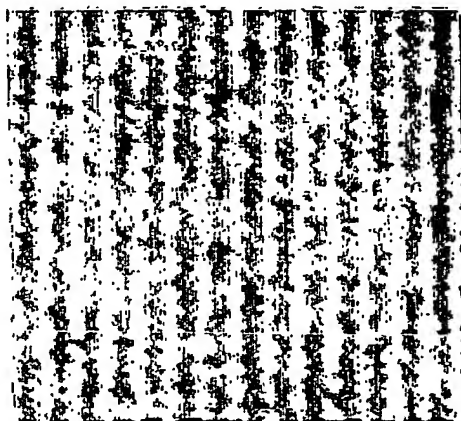
(74) Agent: **RAMBELLI, Paolo**; Corso Regio Parco 27, I-10152 TORINO (IT).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI,

[Continued on next page]

(54) Title: **HOLOGRAPHIC DIFFRACTION GRATING, PROCESS FOR ITS PREPARATION AND ELECTRO-OPTICAL DEVICES INCLUDING THE SAME**



(57) Abstract: Composite polymer/liquid crystal material having a holographic grating structure formed by an alternating ordered succession of polymer layers and nematic liquid crystal layers. The nematic liquid crystal layers comprise an ordered nematic monophase region which is substantially free from liquid crystal droplets. Furthermore, the holographic grating structure is obtained by a process which comprises the steps of: -heating a mixture of a photoinitiator, a monomer and a nematic liquid crystal above the nematic/isotropic phase transition temperature, in order to prevent phase separation and isotropic/nematic phase transition of the liquid crystal; - illumination of the mixture with an interference pattern to induce polymerisation; - slow cooling of the mixture at a rate lower than 0,3°C/mixture, to achieve a complete orientation of the liquid crystal director, and below the isotropic/nematic transition temperature.

WO 2005/006065 A3



SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

— *of inventorship (Rule 4.17(iv)) for US only*

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

Published:

- *with international search report*

(88) **Date of publication of the international search report:**
17 February 2005

(48) **Date of publication of this corrected version:**
24 March 2005

(15) **Information about Correction:**
see PCT Gazette No. 12/2005 of 24 March 2005, Section II

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.